Resource Prospector: Landing Site Survey J.A. M[c]Govern[1], A. Colaprete[2], D.B. Bussey[3], A. Stickle[1], [1]JHU/APL, Laurel, MD · [2]NASA Ames Research Center, Moffett Field, CA, [3]NASA Headquarters, Washington D.C.

Introduction: The NASA Human Exploration and Operations Mission Directorate (HEOMD) have selected a lunar volatiles prospecting mission for a concept study and potential flight in CY2020. The mission includes a rover-borne payload that (1) can locate surface and near-subsurface volatiles, (2) excavate and analyze samples of the volatile-bearing regolith (up to 1 meter), and (3) demonstrate the form, extractability and usefulness of the materials.

Site Selection: A critical facet of the RP mission design is the selection of a landing site that meets several criteria:

1. Evidence of Surface/Subsurface Volatiles
2. Reasonable terrain for traverse
3. Direct view to Earth for communication
4. Sunlight for duration of mission for power

In addition to these four criteria, the overlap of all four must persist for a sufficient amount of time for the mission to accomplish its mission goals. The RP Site Analysis Team has evaluated several example "study sites" to determine if these four criteria can be met for the necessary periods of time. In a number of cases a "baseline" mission (up to 14 days) is evaluated, as well as an "extended" mission possibility in which the rover follows corridors of surface illumination to extend its mission life. In these study cases notional mission operation traverse timelines have been applied to evaluate the feasibility of these sites to meeting mission goals.

This talk will provide an overview of an RP landing site survey. The survey used the LunarShader program, developed by JHU/APL, to find and rank thousands of candidate landing sites. The candidate landing sites were discovered as part of an analysis to find the permanent shadow regions (PSR) near the lunar poles. For the PSR analysis a digital terrain model of the lunar poles is evaluated by simulating the Sun at the sub-solar latitude closest to each pole and keeping that sub-solar latitude constant as the sub-solar longitude is varied in 1/4 degree increments all the way around the pole, 1440 simulations in total. Each pixel is analyzed at each sub-solar longitude using the ray tracing algorithm in LunarShader. For PSRs the interesting points are pixels with a zero value - meaning that no ray was found connecting that pixel to the Sun at any of the simulated positions. High value pixels (e.g. greater than 1300) correspond to locations perched up high relative to nearby terrain. We used these pixels as candidate landing sites for a more detailed study of landing site fitness.

Fitness: Each site is analyzed for access to sunlight, DSN stations, and for slope hazards to determine general fitness as a landing site. The final steps are to group sites with similar characteristics, look for access to areas with enhanced hydrogen detections from orbit, and look for potential daisy chaining by traversing from site to site to extend the mission duration and gain access to greater area.

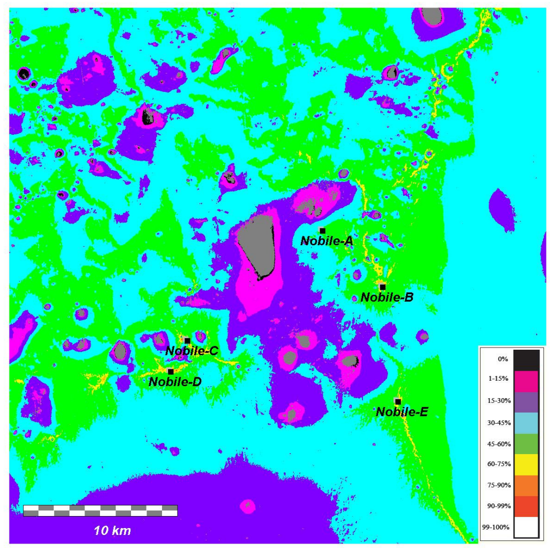

Figure 1. Example illumination map of an area on the rim of Nobile crater with several long mission duration sites called out.